Missouri Department of Natural Resources

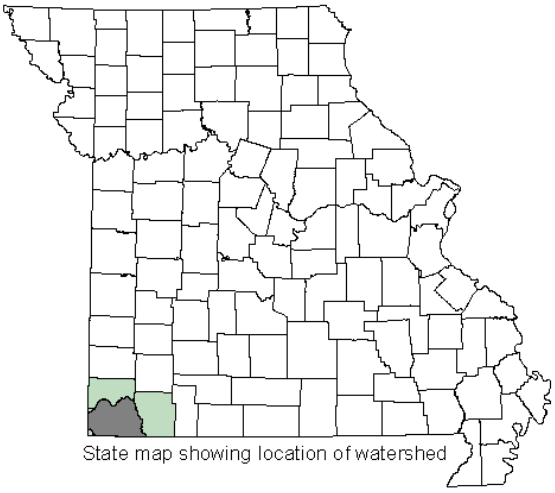
Total Maximum Daily Load Information Sheet

Elk River Basin

Waterbody Segments at a Glance:

Counties: Barry, McDonald, Newton
Nearby Cities: Noel, Anderson, Neosho
Lengths of impairment:
- **Buffalo Creek:** 15.5 miles
- **Elk River:** 21.5 miles
- **Indian Creek:** 26 miles
- **Middle Indian Creek:** 5.5 miles
- **North Indian Creek:** 5 miles
- **South Indian Creek:** 9 miles
- **Patterson Creek:** 2 miles
- **Big Sugar Creek:** 31 miles
- **Little Sugar Creek:** 11 miles

Pollutant: Nutrients
Source: Nonpoint Source Runoff from Livestock Production
TMDL Priority Ranking: Medium


State map showing location of watershed

Description of the Problem

Beneficial uses of Elk River Basin

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life and Human Health associated with Fish Consumption
- Irrigation
- Cool Water Fishery
- Whole Body Contact Recreation
- Boating and Canoeing

Use that is impaired

- Protection of Warm Water Aquatic Life

Standards that apply

Nutrient related water quality standards address proliferation of nuisance algae, turbidity, low dissolved oxygen and organic enrichment.

- The impairment of the Elk River is based on exceedence of the general criteria contained in Missouri's Water Quality Standards, 10 CSR 20-7.031 (3)(A) and (C). These criteria state:
  - Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses.
  - Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses.

Water quality monitoring of the Elk River near the Oklahoma State line has shown a significant steady increase in the amount of nitrogen in the river over the last 35 years. Several factors are believed to contribute to this trend, probably most significantly the large growth of the poultry production and processing industry in Northwest Arkansas and Southwest Missouri. Much of the poultry litter generated in this region, which is high in nitrogen and phosphorus, is applied to agricultural lands within the Elk River watershed. Because nitrogen and phosphorus are water soluble, they are easily flushed from or through soils into groundwaters and surface streams. High nutrient input, whether from nitrogen or phosphorus encourages the excessive growth of algae in a water body. To determine how to stop algal growth, the limiting factor must be found. The limiting factor is the nutrient that limits the growth of plants, in this case algae, if it is not available in sufficient quantities. Generally, a system is either nitrogen or phosphorus limited. The ratio of nitrogen to phosphorus in the average plant biomass is about 7.2 to 1 (Chapra, 1997[1]). An N:P ratio of less than 7.2 suggests a nitrogen-limited environment. A ratio greater than 7.2 would indicates that phosphorus is the limiting element. In the Elk River, the N:P ratio is 17, thereby indicating a phosphorus limited ecosystem.

Both nitrogen and phosphorus in streams can act as a fertilizer, stimulating excessive algal growth in streams. Excessive algal growth can cause large daily fluctuations in dissolved oxygen, including lower than normal early morning oxygen levels that may be harmful to aquatic life. In limiting the amount of phosphorus that enters these impaired streams, growth of algae will be controlled and less likely to create a nuisance.

The watershed has experienced an increase in poultry production that provides the most logical explanation for the surge of nutrient loading that began in 1985. See Figure 6. To address these problems, several 319 grants were approved prior to the writing of the Elk River TMDL. The McDonald County Soil and Water Conservation District/University of Missouri Outreach and Extension, the Department of Natural Resources Water Pollution Control Program (WPCP)/Environmental Assistance Office (EAO) and the Southwest Missouri Resource Conservation and Development (RC&D) Council are in the process of completing projects. These projects promote a variety of best management practices, Comprehensive Nutrient Management Plans for farms spreading poultry litter, informational meetings, watershed management plans and septic tank management.

[1] Chapra, Steven C. 1997. Surface Water-Quality Modeling. WCB McGraw-Hill.

Map of Sampling Sites on the Impaired Portions of Elk River and its Tributaries

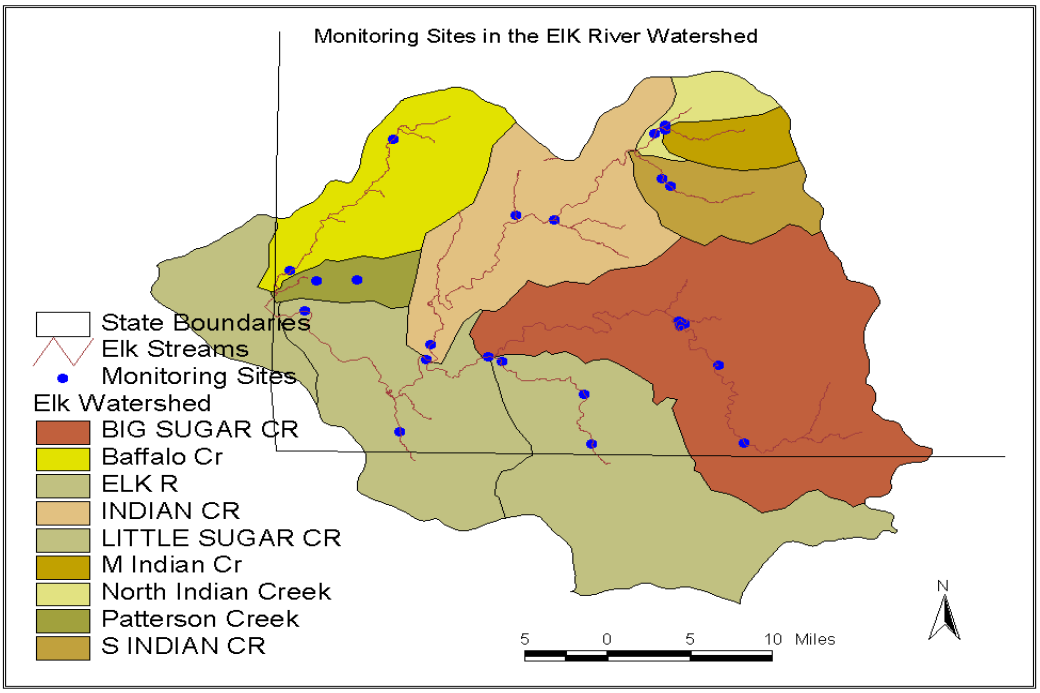
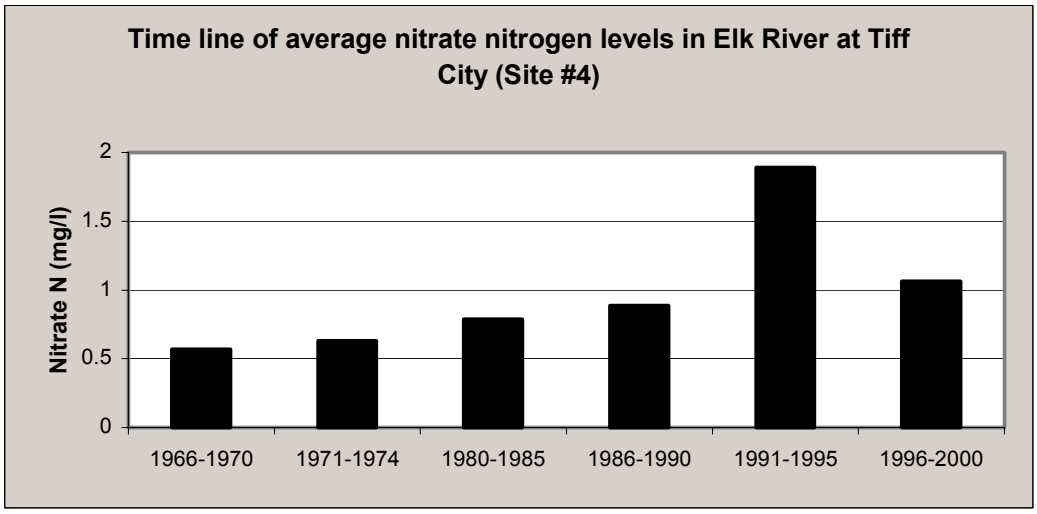
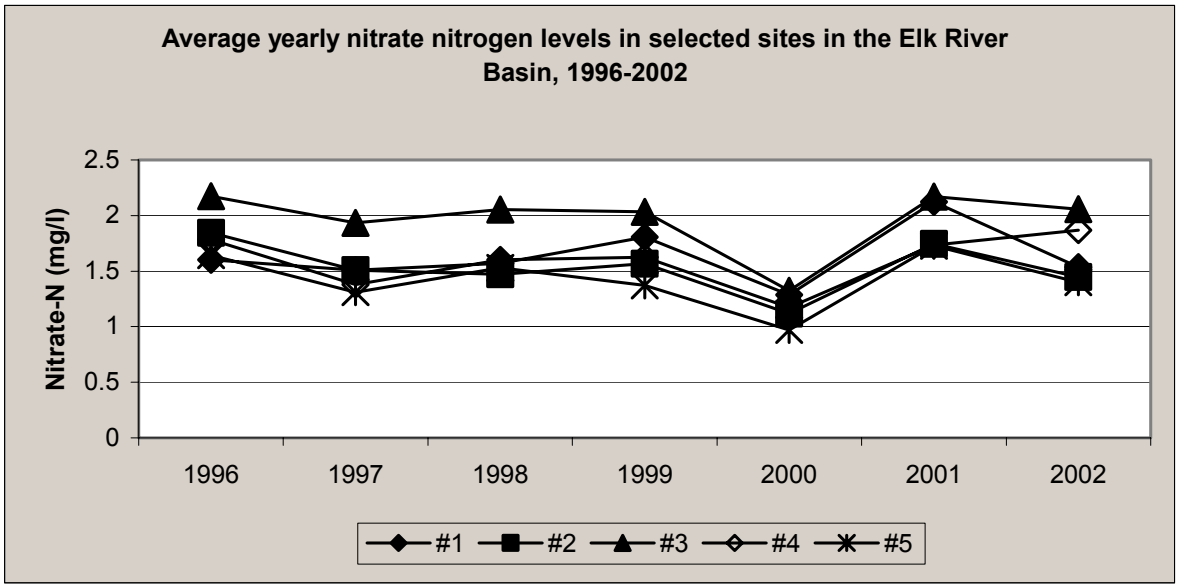


Figure 1
Time line of average nitrate nitrogen levels in Elk River at Tiff City (Site #4)



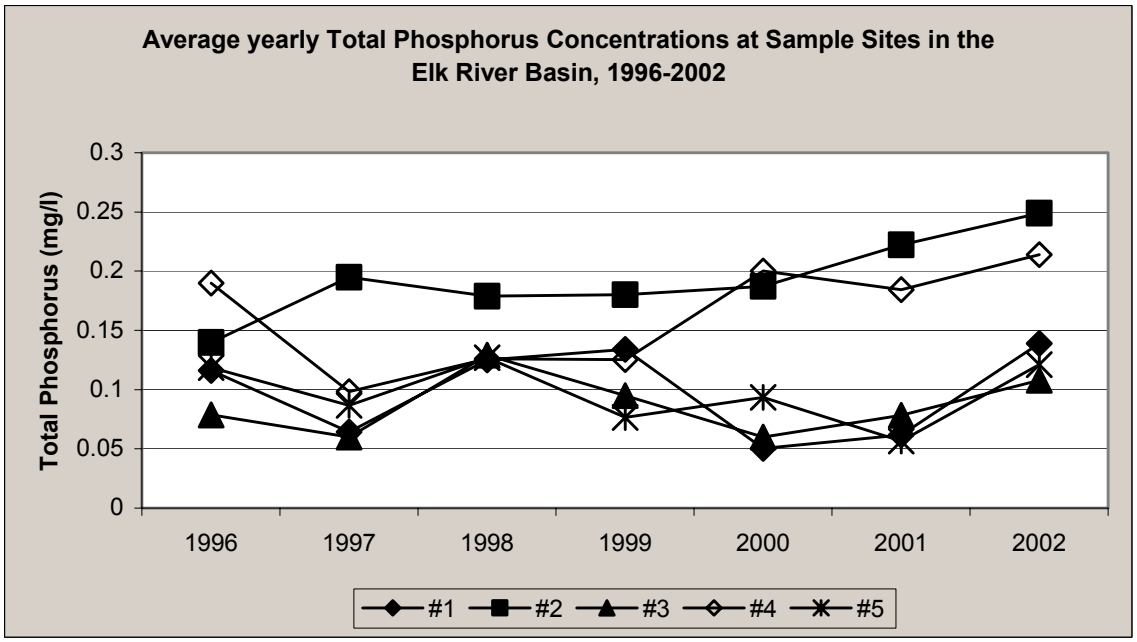
Sources: Missouri Department of Natural Resources, U.S. Geological Survey, Crowder College

Figure 2
Average Yearly Nitrate Nitrogen Levels 1996-2002



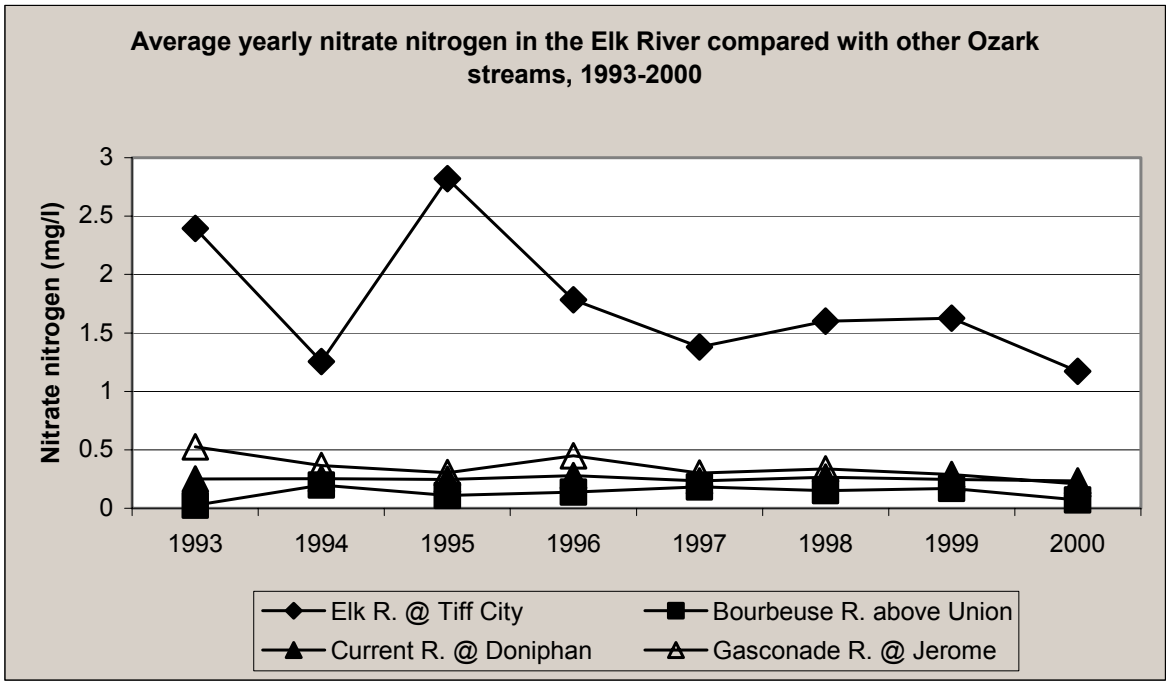
Sources: Missouri Department of Natural Resources, U.S. Geological Survey, Crowder College

Figure 3
Average Yearly Total Phosphorus Concentrations 1996-2002



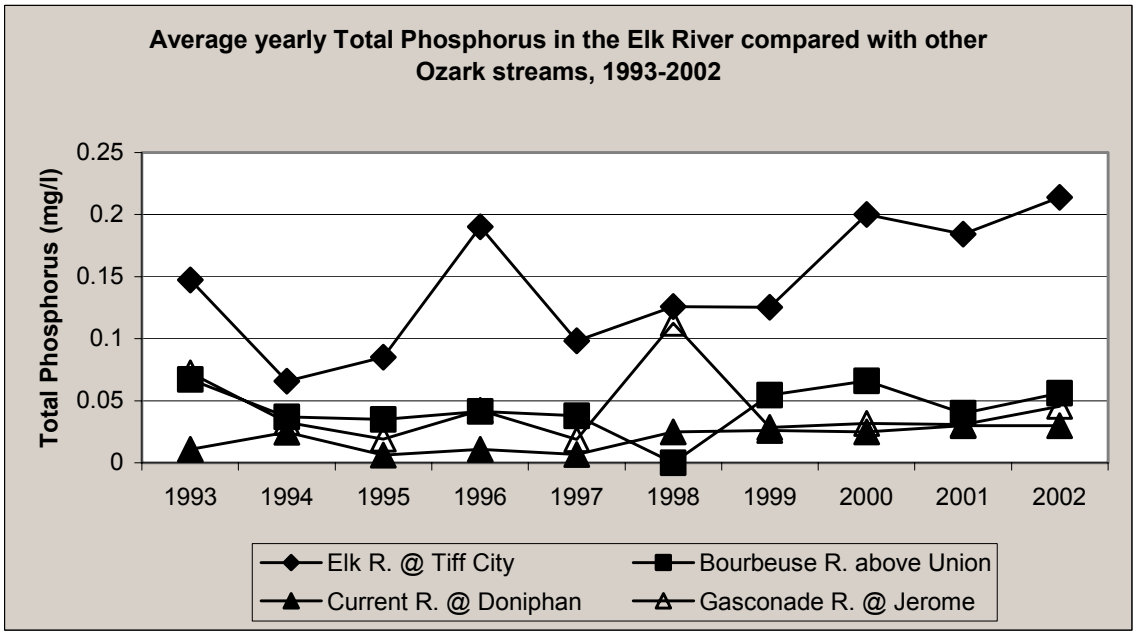
Sources: Missouri Department of Natural Resources, U.S. Geological Survey, Crowder College

Figure 4
Average Yearly Nitrate Nitrogen 1993-2000



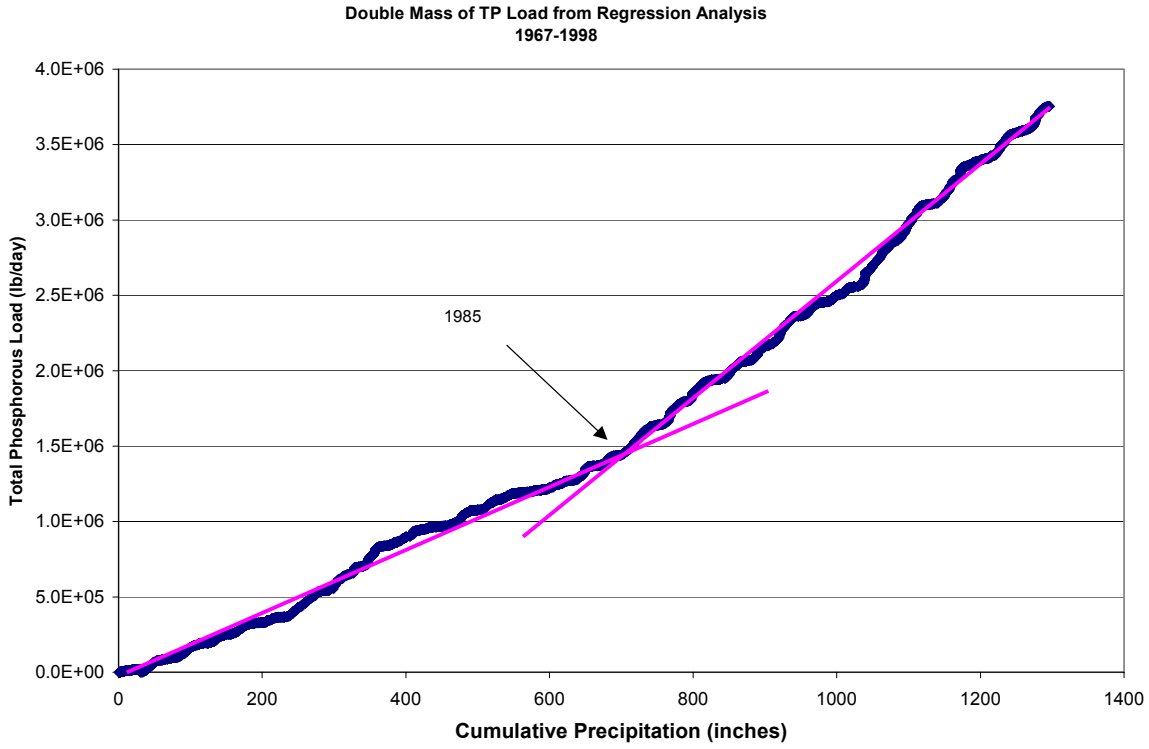
Source: U.S. Geological Survey

Figure 5
Average Yearly Total Phosphorus 1993-2002



Source: U.S. Geological Survey

Fig.6: Linear Regression of Corrected Cumulative TP and Precipitation



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